GrummanWorld

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Future Of A-6 Intruder Still Cloudy

A-6 not funded in Reagan's fiscal '89 budget proposal; fight expected in Congress over omission

BETHPAGE, N.Y., February 19, 1988 — The Grumman A-6 program continues to live a life of uncertainty.

Yesterday, the Reagan administration submitted its fiscal 1989 budget to Congress. The budget proposal did not include funding for any new A-6s.

The Reagan administration is expected to face strong opposition to the omission. Members of Long Island's congressional delegation promised a fight to save the A-6.

"Nothing can be said today that will clear up the issue," says Grumman Aircraft Systems President Renso Caporali. "I personally believe that we are going to have an A-6 program. I'm not saying that to pump people up or to make them feel good. However, I don't know what form it's going to take.

"One thing is certain — it will not be an A-6F," he says. "I expect that we will continue to build A-6E's for a while and then go to some sort of modernized version."

Right now, the company is authorized to build 19 more A-6Es, using funds approved in 1986 and 1987. Production of these planes will continue through the end of 1989.

The administration did ask Congress to permit the Navy to spend $678.9 million on A-6s as part of the fiscal 1988 budget approved late last December.

What's Over The Horizon For A-6? *When* Grumman World *went to press, the future of the Grumman A-6 program was still up in the air. Last week, the President submitted the fiscal 1989 federal budget. It did not include funding for the A-6. A fight is expected in Congress over this omission. (Photo by Rich Breunig)*

This money has not been released pending a decision by Congress and the Navy as to whether it should be used to upgrade A-6Es or to build new ones.

"Needless to say, it's been very frustrating for Grumman," says Caporali. "Nobody has the answers. I'm in daily contact with Washington and they don't have the answers. I met with the board members yesterday and gave them the A-6 lowdown as of 6 o'clock the night before — and 80 percent of that was speculation.

"In the last month, there were at least three deadlines — dates by which everything was supposed to have been settled. Here we are in mid-February, and nothing has been settled yet."

The Grumman A-6 is a veteran of budget wars. "Going through funding conflicts is the nature of this business," says Caporali. "The Intruder was out of the budget in 1980, 1983 and 1986. Each time it was eventually reinstated."

Caporali says that the company is working closely with its congressional representatives in Washington to include funding for the A-6 in the fiscal 1989 budget.

In a *Newsday* article, Representative George Hochbrueckner (D-Coram), a member of the House Armed Services Committee, said, "We'll be building A-6s for a long time. The same arguments that allowed us to get money in the budget for 1988 will allow us money in 1989. You have to add planes to the fleet until the ATA comes along."■

Grumman, Transit Authority Settle Bus Litigation

On Friday, February 19, Grumman Corporation announced an out-of-court settlement of the New York City Transit Authority's longstanding lawsuit concerning 851 Grumman Flxible buses purchased by the Transit Authority.

As a part of the agreement, the Transit Authority along with the City of New York and the Port Authority of New York and New Jersey dropped their $324 million suit against Grumman and two subsidiaries. Grumman agreed to pay the authorities $40 million over the next five years in full settlement of its contractual and warranty obligations.

The buses, a new generation of transit vehicle, were manufactured by a former Grumman subsidiary, Grumman Flxible Corporation of Ohio, and were first delivered to New York City in June, 1980. They were removed from service in December, 1980 after structural cracks were found in their undercarriages. The coaches were returned to service after Grumman repaired them to the satisfaction of an independent panel of engineering experts. In February, 1984, the new administration of the Transit Authority, within a few days of taking office, pulled its Flxible fleet from service permanently, claiming new problems. The Transit Authority then filed suit in May, 1984.

"We are pleased to announce a settlement that just makes plain business sense," said Grumman Chairman Jack Bierwirth. "Protracted litigation, with no immediate end in sight, drains both sides' resources and serves no worthwhile purpose."

Grumman purchased the Flxible Company from Rohr Industries, Inc., in 1978 and sold it to General Automotive in 1983.

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Grumman Reports Sales And Earnings For 1987; Backlog Now At $7.9 Billion

On Friday, February 19, Grumman Corporation announced 1987 net income of $35.7 million or 94 cents a share on sales of $3.4 billion. Net income was after an unusual charge of $26.4 million or 80 cents a share from settlement of litigation over New York City buses and an unusual gain of $35 million or $1.07 a share from the adjustment of deferred taxes. In 1986, the company reported net income of $78.7 million or $2.32 a share on sales of $3.5 billion which included a $7.1 million special gain from the sale of a subsidiary.

Grumman's 1987 income from operations, before the unusual items, was $27.1 million or 67 cents a share. This included an after-tax $36.6 million or $1.12 a share charge against fourth quarter 1987 earnings resulting from the settlement of a contract dispute with the Navy. On February 1, Grumman and the Navy announced they had agreed to share equally $120 million in increased costs on the F-14D aircraft development program, which was being done under a $984 million fixed-price contract.

The results for the year included a $26.4 million or 80 cents a share after-tax loss from discontinued operations which was from the company's $40 million, out-of-court settlement of a $324 million lawsuit against the company by the New York Metropolitan Transit Authority. In 1983, Grumman sold its Flxible bus division, which had delivered over 800 buses to New York.

Meanwhile, 1987 earnings benefited from a one-time gain of $35 million or $1.07 a share because of a change in accounting for the company's income taxes. The company adopted Financial Accounting Standard Number 96 last year which required the adjustment of deferred taxes which will be paid in future periods at lower rates than they were recorded. The tax rate was lowered by the Tax Reform Act of 1986.

For the 1987 fourth quarter, Grumman reported a net loss of $42.4 million or $1.33 a share compared with the year ago net income of $24.8 million or 72 cents a share. Quarterly sales grew to $947.3 million from $930.7 million. In the quarter, the company had a loss from operations of $16 million or 53 cents a share. This included the charge of $36.6 million or $1.12 a share from settlement of the F-14D dispute. Net loss was after the $26.4 million or 80 cents a share loss from discontinued operations due to the settlement of the Transit Authority lawsuit.

Sales in the aerospace segment declined $353 million or 12 percent to $2.5 billion in the year. Due to the transition to a new model, eight F-14 aircraft were delivered in 1987 compared with 24 in 1986. Revenues from the F-14D and A-6F development programs were down as those programs neared completion.

Annual revenues of the special purpose vehicle segment increased $89 million from the Long Life Vehicle program for the U.S. Postal Service. Deliveries, which began in the second quarter of 1987, totaled 7,600 trucks at year end.

In the electronics segment, sales for 1987 increased $154 million or 32 percent primarily from the Joint STARS radar program for the U.S. Air Force and Army and from deliveries of automated test equipment.

The company reported a record backlog of $7.9 billion at year end. This compared with $6.7 billion at the end of 1986.

"The F-14D dispute and the bus suit are behind us as we begin 1988," said John O'Brien, president and chief executive officer. "At present, the major unknown facing Grumman is how the A-6 program will be structured in 1990 and beyond.

"Tight Defense Department budgets make this a difficult environment for all companies in our business," O'Brien continued, "but Grumman's order book of funded programs is the largest in our history and up over a billion dollars in the past year. Our fourth quarter income would have been 59 cents a share without the unusual items. That's a considerable improvement from the second quarter and third quarter. I remain confident that 1988 will be a year of significant sales and earnings growth, and that this trend should continue for the foreseeable future."

Grumman is unable to assess the results of continuing discussions between Congress and the Navy over what version of the A-6 aircraft will be produced in 1990 and beyond. Grumman and the Navy continue discussions on previously announced technical problems on development of the A-6F. Until these matters are resolved, the company will continue to record sales from the A-6F development program on a break-even basis.■

Grumman Corporation

Consolidated Financial Data

(Dollars in Thousands Except Per Share Amounts)

	Three Months Ended December 31		Twelve Months Ended December 31	
	1987	1986	1987	1986
Condensed Income Statement			(Audited)	
Sales	$ 947,288	$930,639	$3,375,260	$3,501,911*
Income (Loss) before Taxes	(24,063)	34,923	41,050	117,190*
Provision for Federal Income Taxes	(8,100)	10,100	14,000	38,500
Income (Loss) from Continuing Operations	(15,963)	24,823	27,050	78,690
Loss from Discontinued Operations	(26,400)	—	(26,400)	—
Cumulative effect of change in accounting for income taxes	—	—	35,000	—
Net Income (Loss)	$(42,363)	$24,823	$35,650	$78,690
Earnings Per Share:				
Primary:				
From Continuing Operations	$ (.53)	$ .72	$ .67	$ 2.32
Loss from Discontinued Operations	(.80)	—	(.80)	—
Cumulative effect of accounting change	—	—	1.07	—
Net Income (Loss)	$(1.33)	$ .72	$ .94	$ 2.32
Fully Diluted:				
From Continuing Operations	$ (.53)	$ .71	$ .67	$ 2.29
Loss from Discontinued Operations	(.80)	—	—	(.80)
Cumulative effect of accounting change	—	—	1.07	—
Net Income (Loss)	$ (1.33)	$ .71	$.94	$2.29
Balance Sheet Data At December 31				
Working Capital			$ 862,881	$ 681,159
Net Property, Plant and Equipment			592,441	521,503
Long-term Debt			643,198	420,974
Preferred Stock			42,588	44,963
Shareholders' Equity—Common			727,414	721,882
Shareholders' Equity per Common Share			$22.27	$22.14
Common Shares Outstanding			32,664,916	32,603,690
Backlog At December 31			$7.9 Billion	$6.7 Billion

* *Includes $7.1 million gain on sale of ISI Systems, Inc.*

Light Metal. *Michael Barbara of the Chem Milling Department in Bethpage's Building 3 applies a liquid called rubber flow coat to portions of aircraft parts protected from acid in the etching process. When dipped in acid, exposed areas of the metal parts are thinned and made lighter without losing any strength. (Photo by Bob Settles)*

EA-6B Prowler To Become More Mobile

Over the last three years, Grumman, the Navy and NASA have been deeply involved in wind tunnel tests of visually subtle but aerodynamically dramatic changes for the EA-6B Prowler.

Aircraft Systems recently submitted a Vehicle Improvement Program proposal to the Navy to develop and test these advanced aerodynamic changes along with engine upgrades and two additional wing stores stations on the Prowler.

The aerodynamic changes, called the Maneuver Improvement Program (MIP), will give the Prowler better flight handling qualities and give the pilots more margin for error.

Grumman engineers are also developing the design requirements needed to add these aerodynamic changes to the Advanced Capability (ADVCAP) Prowler. The ADVCAP version is expected to be in production in 1992.

Internally, the ADVCAP will add new avionics and electronic jamming systems. Externally, the ADVCAP will have two additional stores stations, bringing the total to seven. The ADVCAP Prowler will be able to carry external fuel tanks or High Speed Antiradiation missiles in addition to a full complement of five jammer pods.

"There is nothing on the drawing boards to replace the Prowler and these improvements highlight how important the EA-6B is to the Navy," says Fred McCloskey, program engineering manager. "This program is going to be in place into the 21st Century."

MIP changes will not make the plane look much different. There will be an 18-inch fin extension above the antenna pod on the vertical stabilizer. Less obvious will be the glove strakes, which are short forward extensions of the wing alongside the rear cockpits.

You will have to get close, however, to see the droop added to the leading edge of the wings and slight change made to the undersides of the flaps.

These were done because the EA-6B is more sensitive to control under certain conditions than A-6, on which the Prowler is based. Aerodynamically, the Intruder and Prowler wings are the same; structurally, they are much different.

The A-6 is a lighter aircraft. In addition, it drops its ordnance before returning to the carrrier.

The EA-6B takes off with 12,000 pounds more weight. It has a four-man crew instead of two. It carries jammer pods — two under each wing and one under the fuselage is the maximum load — and returns to the carrier with all of them.

The wings, especially, must bear the immense landing g-force of the jamming pods.

Consequently, the structural design of the A-6 wings and rear fuselage had to be strengthened for its heavier relative.

"The Prowler's wings are so strong," says Lew Byars, vehicle project engineer, "that no EA-6B in service has expended more than 26 percent of its fatigue life. It's one of the early production aircraft." The first Prowlers went into the fleet in 1971.

The first Prowlers also received more powerful engines and some aerodynamic changes to the A-6 wing design to accommodate the extra weight. These worked fine for the early Prowlers.

However, a series of electronic warfare capability upgrades have added more weight. In certain conditions, a slight change in airspeed or angle of attack can bring on a sudden stall.

The fourth-generation ICAP II, now in production, and the upcoming ADVCAP, weigh even more.

"We designed the necessary strength into the airframe with the original design," says Byars. "What these changes do is find some ways to improve the handling qualities."

Over the past three years, Grumman engineers worked with NASA designers and model makers to come up with design changes that would solve the problems, yet not requiring major structural changes. Extensive wind tunnel tests were conducted.

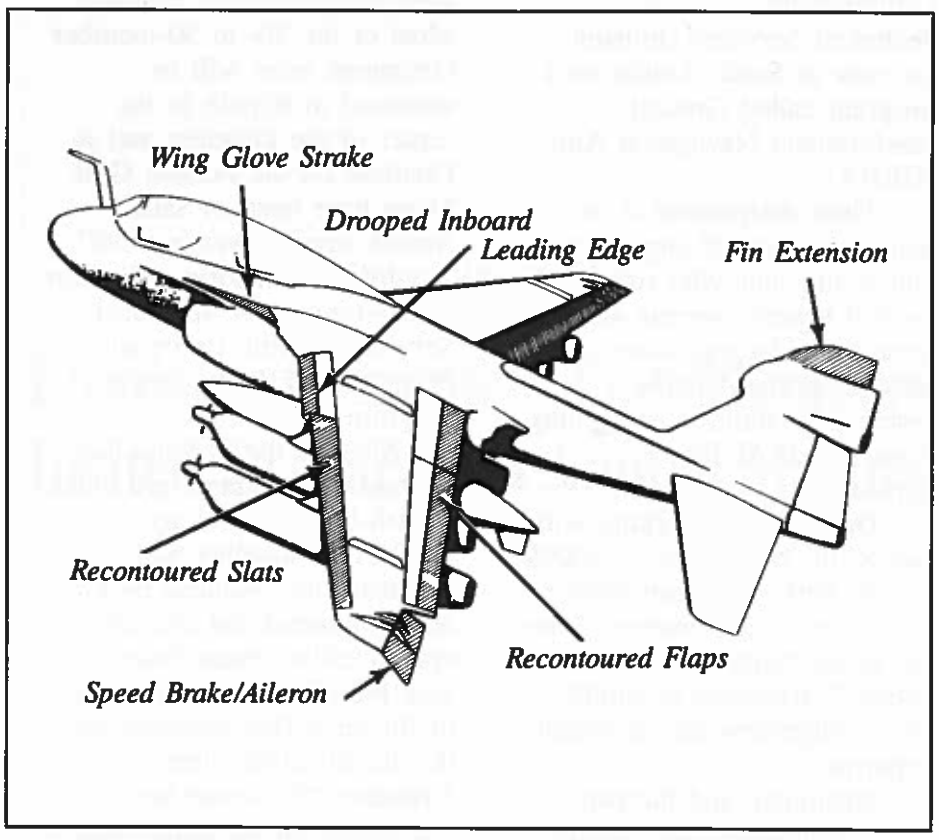
In all, five different models, each modified as the need required, were built to test Grumman's aerodynamic ideas.

One of the biggest headaches the engineers had was the spinning cone of air that peels off from the wing where it meets the fuselage. In level flight this vortex is no problem. As the plane's nose pitches up into higher angles of attack, however, the vortex slowly rises to the level of the vertical tail. It reduces lift.

What's worse, at stall the tail becomes immersed in the vortex and becomes ineffective in providing directional stability.

The solution was the glove strakes alongside the rear cockpits. These help keep the airflow tighter to the wings. Consequently, there's control of the vortex and more lift at higher angles of attack.

To get better directional stability they tried canting the horizontal stabilizers up, they thought of twin tails and even a vertical fin on the underside of the tail. But the best, and simplest, solution was an fin extension above the antenna pod.



Points Of Interest. *This drawing shows the location of aerodynamic changes that will be part of the Advanced Capability Prowler. None of these changes will require any extensive structural modifications.*

To help with lateral control, Grummanites decided to utilize half of the speed brakes as control surfaces, called ailerons, on the trailing edge of the wing. The speed brakes are the two rear halves of the wing tips. In normal use, one opens up, the other down, to slow the plane on landing. They let the pilot keep the engine power up so he can safely fly off if the arresting hook misses the cables.

The MIP changes utilize the bottom half of each speed brake as a control surface to give the pilot better control.

The Grummanites also gave the leading edge of the wing a little droop, and the trailing edge a little downturn at the edge like a modern supercritical wing. These subtle changes give the plane more lift while reducing drag.

Most importantly, none of these changes involved any major structural redesign of the EA-6B.

MIP changes will be flight tested in MR-50, a prototype Prowler that will fly in 1991. They will also appear in MR-51. This second plane will integrate the aerodynamic and engine upgrades of MR-50 with the new electronics being developed for ADVCAP.■

Board Approves Share Purchase Rights Plan

On Thursday, February 18, the Grumman board of directors adopted a share purchase rights plan.

Grumman is not aware of an impending takeover attempt.

As part of the plan, Grumman declared a dividend distribution of one preferred stock purchase right for each outstanding share of Grumman common stock. If Grumman is acquired and the rights are exercised, each right will entitle the holder to purchase, for $80, shares of the surviving company having a market value of $160.

The rights would allow Grumman stockholders to benefit from the underlying values of the company and also assure that they would receive fair treatment in an attempted takeover. Several other aerospace companies have recently taken the same action, because of the impact of the stock market crash on their stock value.■

Technical Services Working On Saudi Arabian Program

Grummanites from the Technical Services Division are now in Saudi Arabia on a program called Ground Environment Navigation Aids (GENA).

Their assignment is to manage a team of engineers and technicians who run control towers, operate and maintain radar and other navigation and defense systems, in addition to training Royal Saudi Air Force personnel.

Grumman is working with two Saudi companies — ASAS and El-Seif. This team had won a three-year contract from the Royal Saudi Air Force and enlisted Grumman to supply the management and technical expertise.

Grumman and the two Saudi companies hired some 300 technicians, most of whom are British nationals, from the previous contractor. That number could grow to 700.

They are working at 12 sites throughout the country. Most of the 20- to 30-member Grumman team will be stationed in Riyadh in the center of the kingdom and in Dhahran on the Persian Gulf. Many have been in Saudi Arabia since November 1987.

Jim Smith, former director of Operations for Technical Services' Shuttle Processing Program in Florida, is the program manager.

Most of the systems they operate and maintain are older, British-built technology.

"These systems will eventually be replaced by a new command and control system called Peace Shield," says Joe Klimek, the director of Business Development for the Technical Services Division. "It should be operational in the early '90s. We believe that having the GENA project will place us in a good position to bid the Peace Shield project."■

What's The Problem? *Brenda Phippin (L), and Margaret Collins of Electronics Systems in Salisbury, Maryland, troubleshoot a test cable.*

Grumman To Maintain USAF Computer Network

Grumman Systems Support recently won a contract to maintain computers at six Air Force Logistics Centers.

The contract is worth approximately $3 million and spans five years. Grumman will maintain computer equipment in the Air Force's Stock Control and Distribution System. Grumman's contract is with Computer Sciences Corporation, the company that designed and developed this system.

The logistics centers are at these Air Force bases: Warner Robins, Georgia; Wright-Patterson, Dayton, Ohio; Tinker, Oklahoma City; McClellan, Sacramento, California; Kelly, San Antonio, Texas; and Hill, Ogden, Utah. The contract covers equipment from about 20 different manufacturers. Included are personal computers, printers, bar code readers, and minicomputers.

"Traditionally, we have specialized in larger central processors and peripherals of the same make, usually from Digital Equipment Corporation or Data General," says Charles Munzer, director of Federal Marketing for Grumman Systems Support. "Today, many networks are like the Stock Control and Distribution System: very powerful small computers hooked up to a variety of other brands of equipment.

"If the customer buys vendor maintenance, it ends up with 15 or 20 different service contracts. Such organizations are a natural for a third-party maintenance firm, which can handle all of their needs." Third-party maintenance is provided by a company other than the manufacturer or vendor.

The logistics centers maintain and repair the Air Force's munitions. The Stock Control and Distribution System interconnects the six centers, providing on-line information on all the equipment and spare parts in inventory. The entire computer network has only been in operation since the end of 1987, though parts of it went on-line earlier in the year.

"Some of the hardware in the system is still under warranty," says Munzer. "As those warranties expire, our equipment list will grow."

Only Oklahoma City was a brand-new location for Grumman Systems Support. "Even though we had some business in five of the six areas before this, this contract gives us added visibility and credibility," says Munzer. "It will become easier for our salespeople to sell our service.

"In addition, these are big bases," he continues. "In mid-1987, we received a contract for DEC maintenance at Warner-Robins, and we have two other bids now pending there and at McClellan," he says.■

Board Approves Seven Appointments

On Thursday, February 18, the Grumman board of directors approved the appointments of six Grummanites.

In Aircraft Systems, Tom Kane was appointed senior vice president-Business Development; Norm Lewin, senior vice president-Technical Operations; Bob Watson, vice president and chief engineer; and Don Markarian, program vice president-F-14. In Data Systems, Joseph Mulderig was appointed president of Grumman Systems Support. In Melbourne Systems, Gerry McNiff was appointed vice president-Technology.

Tom Kane joined Grumman in 1959 as an experimental flight test engineer. In 1975, he was elected a vice president of Grumman Aerospace. He most recently had been vice president—Customer Requirements for Aircraft Systems.

A Grummanite since 1953, Lewin began his career in Research. In 1983, Lewin was appointed deputy director of engineering and in 1985 was named director. He was named vice president and chief engineer for Aircraft Systems in 1986.

Watson had been F-14 program vice president since 1985. He first joined Grumman in 1955. He joined the F-14 program in 1976 as its engineering manager, and later served as deputy director—Technical and program director, F-14D Development.

Markarian started at Grumman in 1966 in Advanced Systems. He later served as Lunar Module program manager and deputy director, and Shuttle Wing program director. He joined the F-14 program in 1976 and had most recently been its program director.

Mulderig joined Grumman in 1966 as an E-2A electronics technician. He helped set up Systems Maintenance Services and was named vice president, Service Operations, in 1984. The unit was renamed Grumman Systems Support in 1985 upon acquiring another firm.

McNiff began at Grumman in 1968 as a senior radio-frequency equipment engineer. He had been Melbourne Systems' director of technology. McNiff patented a radar concept that led to a succession of programs, culminating in the Joint Surveillance Target Attack Radar System (Joint STARS).■

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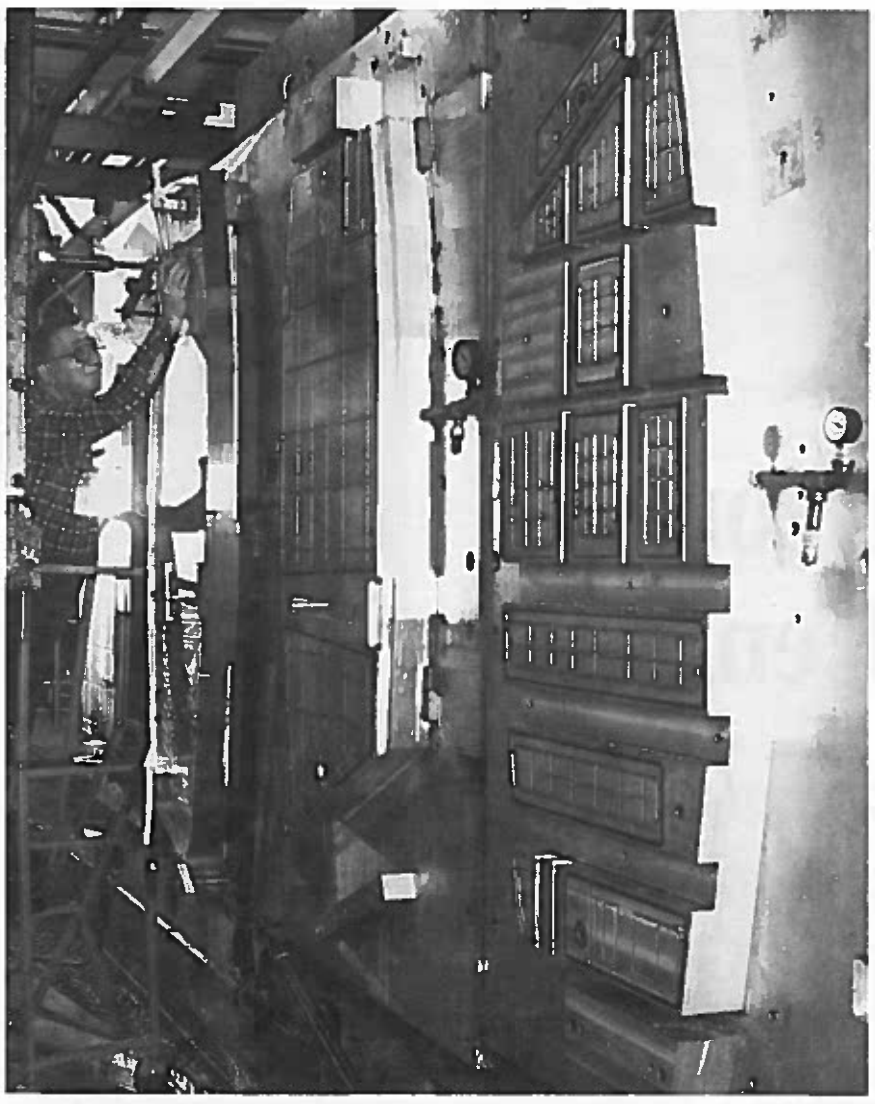

Precision Touch. *In Building 3, Bethpage, numerical control machinist Ray Wrobleski inspects a wing fold for the E-2C Hawkeye. This huge part is made from solid aluminum on the Five Axis Cincinnati Machine. It enables the wings to fold for storage on a carrier. (Photo by Bob Settles)*

Investment Plan Inquiry

I'd like to have the following topic discussed: .....

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Mail to: EIP, C15-GHQ

Employee Investment Plan Members Invited To March 24 Annual Meeting

The annual meeting of the Grumman Employee Investment Plan takes place Thursday, March 24. All plan members are invited to attend the meeting, which starts at 5 p.m. in the Grumman Headquarters' auditorium.

Representatives of the firms that manage the equity, fixed income and guaranteed income funds will be present as well as representatives of the bank recordkeeper.

There will be reports on the performance of the plan's funds over the past year and projections of their future performance.

Attendees will have the opportunity to ask the plan's managers questions.

So that a maximum number of inquiries may be answered, the Employee Investment Plan office suggests that you fill out the form on this page if there are certain topics you would like discussed. These suggestions are important — the evening's agenda is usually planned around them. Mail your inquiries to the Employee Investment Plan, C15-GHQ.

A summary of the meeting will be published in an upcoming issue of *Grumman World*.■

Students: Your Tuition Refunds May Now Be Taxable

If you attend college and depend on Grumman for tuition reimbursement, you may have to pay taxes on some of the money you get back.

As a result of a change in the tax law, only reimbursement for courses *directly related to your job are now tax-free. Any money you get back for non-job related courses is now considered taxable income.* The change affects all payments received after January 1, 1988 — even for courses taken in fall 1987.

On December 31, a Federal tax provision expired that had exempted all tuition assistance from income and Social Security taxes. The change does not affect your eligibility for Grumman's Tuition Reimbursement program — only what you can be taxed for.

"Suppose you take six courses in a year at New York Polytechnic University," says Joelyn Iannone, director of Corporate Training and Motivational Programs. "If you earn all A's, at $1,200 a course, Grumman reimburses you a total of $7,200.

"That used to be tax-free compensation," she continues. "Now, if none of those courses is directly related to your present job, you will have $7,200 more in taxable income."

All Grumman divisions except Allied, St. Augustine, and Technical Services participate in the Tuition Reimbursement program. Those three divisions administer their own plans, with subtle differences among them. This new tax rule, however, applies across the board.

Starting with the Spring 1988 semester, you must fill out and sign a new course-verification form when you apply for reimbursement. You must list job-related courses and obtain a supervisor's signature (section head or higher level management for engineering people). Employees who have filed a claim for the fall 1987 semester will be notified through interoffice mail if they will be taxed.

"Job-related courses" are those that maintain or improve skills used in your current job, or are required by the company to keep it. If a course is part of a program of study that will qualify you for a new job, career upgrade, or career change, it is not job-related. The same rule applies to a course required to satisfy a minimum educational requirement.

The change has an impact on Grumman as well as the individual. Grumman will have to evaluate courses taken by employees much more closely. Also, Corporate Training will only issue checks through the accounting department for tax-exempt courses. For taxable courses, you will get your check from Payroll — minus your tax and social security payment.

"Furthermore, the old rule let us enhance our career development program," says Iannone. "The guy or gal in the shop could study engineering at night. A secretary could study business administration. They can still do that, but they will be taxed because their courses are not directly related to their present jobs."

"It is unfortunate, but this tax change will have the hardest impact on people starting their careers," says Lorraine Alfino, administrator of the Tuition Reimbursement program. "When they go to school, they are usually studying to qualify for advancement."

Here are some hypothetical cases that can help you determine whether your courses qualify for tax-free tuition reimbursement.

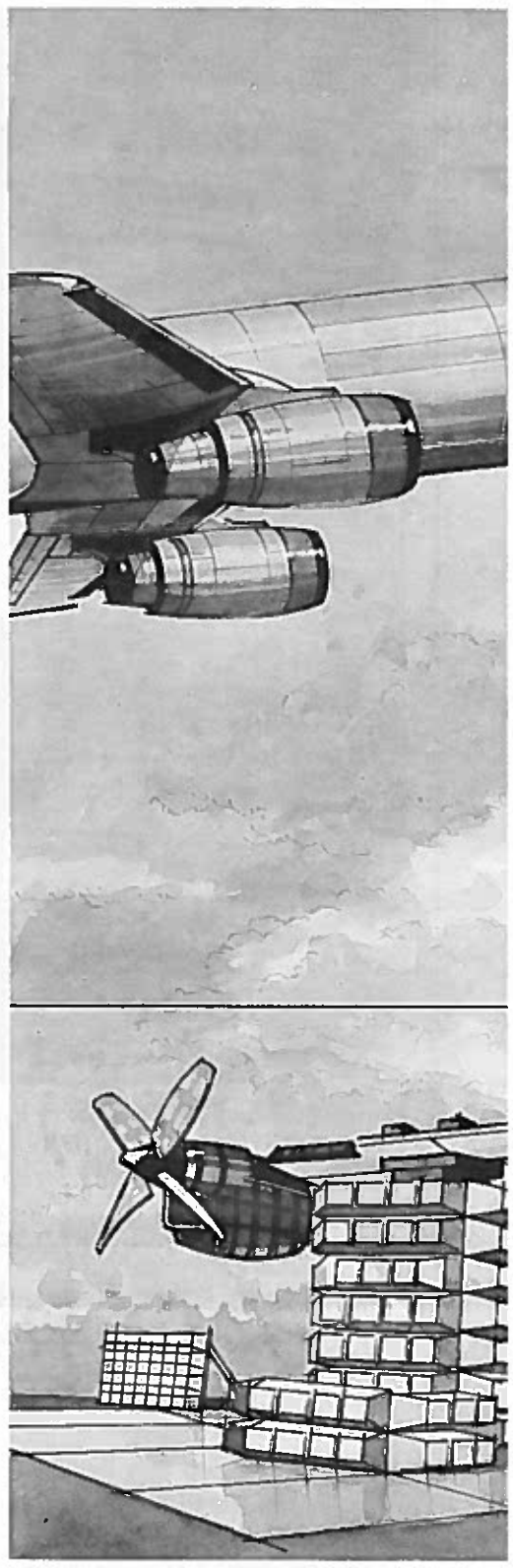
- An assembler/riveter is enrolled in business management courses, aiming to better qualify for a promotion or career in business administration. These courses are not directly job related. The skills they develop have no relationship to the employee's present position and any reimbursement would be taxable.
- An engineering aide enrolls in an evening engineering program that could lead to a degree. The program involves many courses not related to the employee's current job. Reimbursement would be taxable since the curriculum would lead to a new career.
- A clerical employee — such as a secretary or accounting clerk — enrolls in an undergraduate business administration program. The course of study will prepare the person for a new job or career and reimbursement will be taxable.
- A person with a bachelor's degree in business works in accounting. The employee enrolls in a graduate finance course. The course is job related and reimbursement would not be taxable. This course is not part of a study program that would qualify the employee for a new career.
- An engineer with significant supervisory, financial and management duties enrolls in a graduate business program. Since these studies relate to the person's current job, tuition reimbursement would be non-taxable.

The key is that this engineer already has a supervisory position — such as group leader, project leader, project engineer, or engineering manager. An engineer with no such responsibilities who pursued the same courses would be taxed.

More information is being distributed to company training representatives.■

What's Over The Horizon At The Turn Of The Century?

Grumman's Advanced AEW group explores new technologies for use in the next generation of U.S. airborne early warning systems



The Airborne Early Warning (AEW) field is not for neophytes. It takes many years to gain prowess in the complexities of AEW.

"Grumman has been preeminent in the field for over three decades. Our strength lies in our experience," says Aircraft Systems President Renso Caporali.

Since the early '70s, Grumman engineers have been laying the groundwork for the next generation of AEW radar. Over the years, Grumman has spent millions of its own dollars in the research and development of critical technologies needed for the next AEW system. From 1987 through 1990, Grumman is investing $60 million alone.

This internal research-and-development work has positioned Grumman to win advanced AEW contracts that are beginning to surface. In mid-1987, the U.S. Air Force selected Grumman to develop radar technology for the Atmospheric Defense Initiative (ADI). ADI deals with ways to detect strategic bombers and air- and sea-launched missiles which fly in the lower atmosphere and hug the curvature of the Earth. An airborne early warning system may be a part of ADI's surveillance, tracking and weapon systems network.

The initial contract is worth $2.9-million; two other firms — Westinghouse and Hughes — won similar development contracts. The Air Force plans to conduct a full and open competition for building advanced development models after the development contracts are concluded. Upon completion of that phase, a competitive award would be made for full-scale development of the ADI radar.

The next generation of AEW will probably enter service at the turn of the century. Most aerospace firms believe that there will be a lot of commonality between the Navy's and the Air Force's next AEW system.

Both armed services will be facing many of the same threats. Very low-flying missiles can skim the earth's terrain, hiding in the "shadows" created by low hills and avoid radar detection. In addition, quick acting surface-to-surface and air-to-surface missiles further shorten warning times in the battle area and this means very rapid data processing is needed.

'The radar is by far the most critical aspect of AEW.'

"The next generation of AEW is still in its embryonic stage," says Pat Wiley, director of Advanced AEW. "Which platform will carry the new AEW system aloft is unimportant right now. At this stage, the primary concern is the development of critical technologies." In early 1986, Aircraft Systems Division consolidated all its advanced AEW efforts under one program. Sixty engineers work on the new Advanced AEW Program, which is part of the Advanced Programs Department. The Grummanites are concentrating on three critical areas: detection of small targets, adaptive processing for cancellation of clutter and jamming, and phased array technology.

"The radar is by far the most critical aspect of AEW," says Fred Ganz, technical director of Advanced AEW. "It operates from an airborne platform as opposed to ground-based radar. Up in the air, it not only picks up targets but also ground clutter. The land clutter reflections from buildings and other objects can be thousands of times stronger than the target itself. The method to sort out the small target from ground clutter involves very advanced signal processing techniques."

Ground clutter has always been troublesome. Ganz points out that it took Grumman 20 years from the deployment of the first E-2A in 1962 to get the Hawkeye's AEW radar to work over land. "Water still reflects some clutter, but it's a lot less."

An AEW radar must also contend with ground traffic — cars and trucks. It must weed out all the moving traffic on the ground and end up just with the airborne targets. Another obstacle facing the AEW radar is size constraint since it's on board an aircraft.

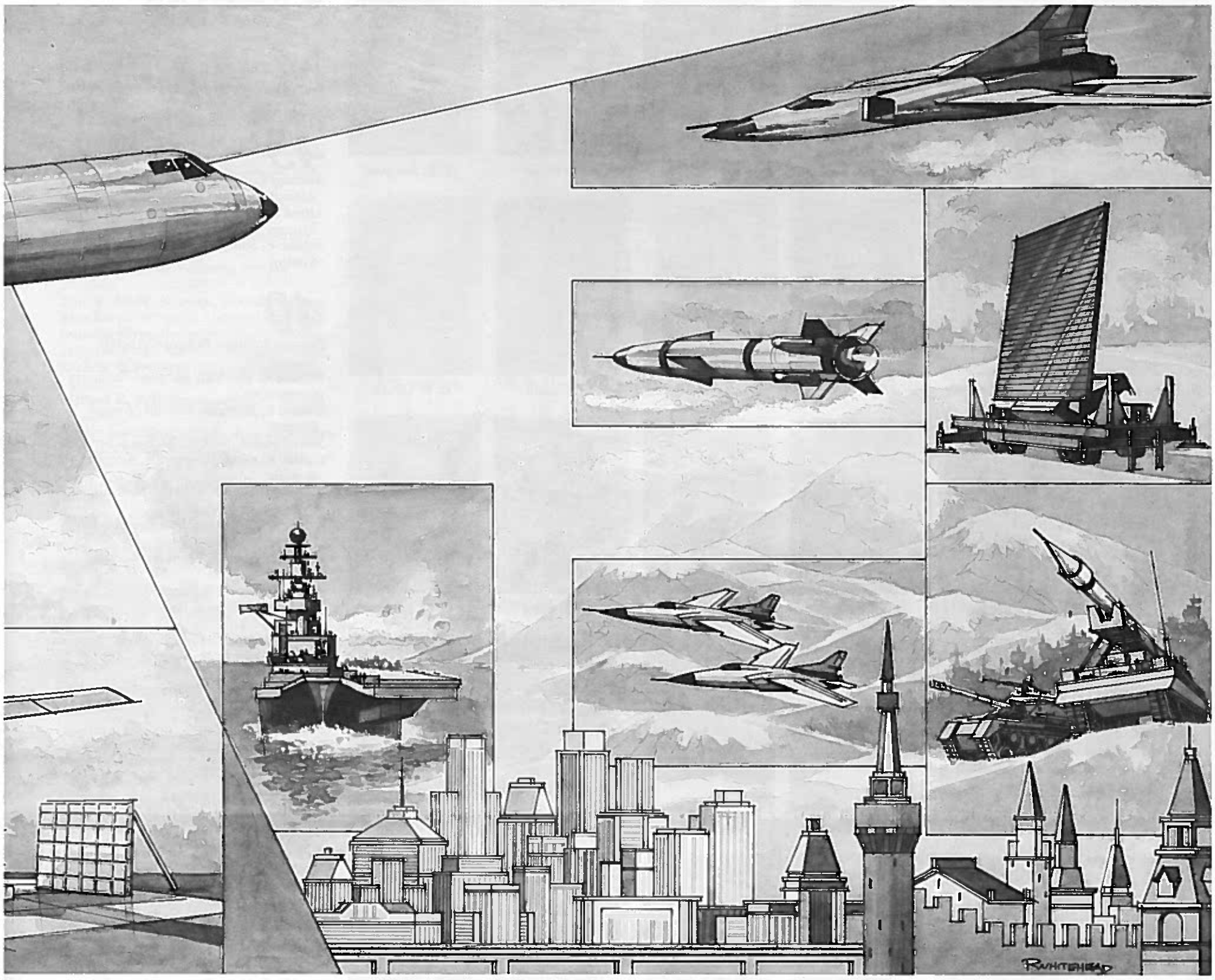
'The next generation of AEW is still in its embryonic stage.'

Today's E-2C and the Air Force's E-3A AWACS use mechanically scanned rotodomes — the radar is perched on top of the aircraft and rotates 360 degrees. Grumman has developed conformal radar concepts using phased array antennas installed in the side of an airframe, and on the leading edge of the wings. "A conformal radar lets you scan 360 degrees without using a rotodome," says Ganz.

Ganz says that using phased array antennas is the industry trend for future radar systems. "For many years, we were the leaders in this technology," says Ganz. "The rest of the industry has done a lot of work on phased array antennas, and several firms, especially Westinghouse and Hughes, have caught up to us.

"The phased array antenna offers more flexibility," says Ganz. "Each antenna element is computer-controlled to provide an electronically steered beam. Because you can control the beam electronically, a phased array antenna can perform a number of radar functions: searching, detecting, tracking. We can vary how often we look at the targets. Electronic scanning provides the flexibility to concentrate on specific areas of interest while maintaining continuous 360-degree surveillance."

Grumman holds several patents dealing with phased array radar. One company patent



(Artwork by Bob Whitehead)

involves the technology used to put advanced phased array antennas in the airfoils. Another pertains to measuring the speed of targets. Today, the speed of an approaching target is determined by measuring range changes from scan to scan. Grumman has invented a system that uses advanced wave forms to measure the speed of the target right at that instant time.

'A conformal radar lets you scan 360 degrees without using a rotodome.'

The emerging small-target threat will render many of today's radars obsolete, says Ganz. "The problem is so difficult that simple modification or upgrades to today's radars would be ineffective," he says. "Major technology advances are required which dramatically alter the basic architecture of the radar itself."

An advanced signal processing system is required to perform a myriad of tasks, from sorting the radar returns by range to filtering out clutter to performing automatic target detection.

A lot of the software is being "built" into the advanced AEW system. "The system is so complex that you can't afford to have a lot of ECPs — engineering changes — later on down the line," says Wiley. "For this reason, we are conducting in-depth simulations which, in essence, model our design on the computer."

At various stages of the advanced radar development, Grumman has conducted tests, usually with the radar 50 to 60 feet above ground. For example, in the rooftop radar lab in Bethpage, tests have been run using P-3 aircraft and Lear jets as targets. "We measure radar range, how well we can track the target and radar accuracy," says Ganz. "We also experiment with update rates — how often we go back and look at that target."

In the summer of 1985, Grumman successfully tested a phased array antenna installed in the leading edge of an E-2 wing outer panel. Funded by the Navy, the tests demonstrated the inherent anti-jamming characteristics of phased array radar. "The antenna patterns are shaped so that they null the jamming signals and only see the target," says Ganz.

Anti-jamming features will be crucial to survival of the next AEW system. One of the problems with any radar system is that it must transmit a signal in order to get a return for analysis. However, by radiating energy, the AEW system is telling the enemy its location and thus making itself a target or subject to jamming.

'The antenna patterns are shaped so that they null the jamming signals and only see the target.'

Another key technology for future AEW radars is adaptive processing. Advanced algorithms are used that sense the radar's environment — be it clutter or jamming — and automatically make adjustments to keep the radar working at peak efficiency. The technologies used are crucial to detecting the small targets, and represent a major area of development in the Advanced AEW program. If these developments are successful, they would be applied to the current E-2C Hawkeye as well as future AEW aircraft. The prototype hardware is now being developed and will be ready for flight test by 1990, according to Bill Jorch, manager for Development.

Last year, the Advanced AEW group began a major update of its radar lab in Building 14 in Bethpage. When completed, the lab will allow Grumman engineers to thoroughly test the phased array radar concepts. The roof-top lab can accommodate actual aircraft wings, or large fuselage-mounted antenna arrays.

"Right now, we're doing our design homework. There is still a lot of software development and integration work to be done," says Wiley. "We are approaching our work as if it were a flight development program. We're designing flexibility into our hardware, so when the system goes into flight tests, we'll be able to make adjustments."■

V. L. Accolla

J. P. Allison

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W. M. Baillie

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H. L. Berman

H. H. Bontempi

C. E. Bookbinder

K. M. Bryers

F. Busle

H. Caccia

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K. C. Carmen

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R. E. Knoetgen

D. E. Knowles

R. G. Kudla

D. Q. Lewis

S. A. Licari

D. J. Lindeman

Service Milestones

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Alfred E. Munier, Bethpage, Aircraft Systems
Arthur E. Sobisek, Calverton, Aircraft Systems

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Edward F. Barta, Bethpage, Aircraft Systems
Willard R. Bischoff, Bethpage, Grumman Corporation
Donald C. Broggini, Melville, Aircraft Systems
John Combes, Norfolk, Technical Services
George Eyring, Milledgeville, Aircraft Systems
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Joseph H. Whitney, Calverton, Aircraft Systems

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Jacque Caffrey, Norfolk, Technical Services
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Augustine J. Lanzo, Bethpage, Corporate Services
Eugene Miritello, Bethpage, Corporate Services
Ignatius S. Papa, Bethpage, Corporate Services
Charles J. Pchanka Jr., Bethpage, Aircraft Systems

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Robert Geist Jr.,, Bethpage, Aircraft Systems
Stephen R. Hambsch, Melville, Aircraft Systems
William B. Haynes Jr., Melville, Aircraft Systems
Alfred P. Korte, Calverton, Aircraft Systems

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Peter Alford, Bethpage, Technical Services
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Donald B. Anderson, Bethpage, Space Systems
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Edward J. Baran, Melville, Aircraft Systems
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Jimmy Garraffo, Bethpage, Aircraft Systems
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Richard J. Gogarty, Bethpage, Aircraft Systems
Salvatore Greco, Bethpage, Aircraft Systems
Eugene J. Griffin, Melville, Aircraft Systems
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Cecil E. Hollar Jr., Melville, Aerostructures
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Donald Q. Lewis, Bethpage, Aircraft Systems
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Douglas J. Lindeman, Bethpage, Aircraft Systems
Josephine A. Loeffler, Bethpage, Data Systems
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Ernest G. Maines, Calverton, Aircraft Systems
Martin K. Makboulian, Bethpage, Data Systems
Philip W. Mason, Bethpage, Aircraft Systems
Thomas C. McKessey, Bethpage, Data Systems
Nicholas G. Milonas, Bethpage, Data Systems
James K. Mollsen, Tulare, Allied
Richard P. Montgomery, Calverton, Aircraft Systems
Gerard A. Morris, Bethpage, Aircraft Systems
Philip Motley, Bethpage, Aircraft Systems
Peter J. Murray, Bethpage, Corporate Services
Norman Naps, Melville, Aerostructures
George E. Negri, Bethpage, Aircraft Systems
Carlos A. Paez, Bethpage, Aircraft Systems
Jack Pantano, Melville, Aircraft Systems
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Frank V. Prisco, Melville, Aircraft Systems
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T. C. McKessey

N. G. Milonas

J. K. Mollsen

R. P. Montgomery

G. A. Morris

P. Motley

P. J. Murray

N. Naps

G. E. Negri

J. Pantano

R. A. Patrie

R. K. Patwell

A. Pellitteri

J. J. Pierini

M. I. Plawsky

T. J. Restivo

J. Ruszkai

E. R. Salage

J. W. Schachter

G. F. Serviss

W. Slawata

H. H. Smith

A. L. Spencer

R. E. Strickland

A. G. Tomlison

W. K. Toolan

R. F. Travelyn

J. Triolo Jr.

M. Ugenti

A. J. Vitzthum

L. H. Wagner

E. G. Wanke

James Ruszkai, Bethpage, Aircraft Systems
Edward R. Salage, Bethpage, Aircraft Systems
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George F. Serviss, Bethpage, Aircraft Systems
William L. Skinner Jr., Bethpage, Corporate Services
William Slawata, Calverton, Aircraft Systems
Herbert H. Smith, Calverton, Aircraft Systems

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W. P. Whittard

J. N. Wiley

R. P. Witt

M. V. Wojtyniak

J. L. Woodford

J. T. Zalesak

J. W. Zuchorski

Department Profile

Media Control Keeps Computers Well Fed

For engineers to design new capabilities for the F-14, they need as much information as possible about the entire aircraft. When they log onto their computers and that information is at their fingertips, they can thank Grumman Data Systems' Media Control Department.

The department is responsibile for the storage management of over 600 gigabytes of information used by Grummanites each year. There are 1 billion bytes of information in every gigabyte.

"We maintain a library of close to 100,000 tapes and cartridges," says Ken Watson, assistant director of the Media Control Department.

The department serves the Bethpage, Melville and Holtsville computer facilities on Long Island. The department is divided into three specific areas: Tape and Cartridge management, Direct Access Storage Device (DASD) Management, and Operations Software Support.

Data is stored on disks or tapes and cartridges. Information stored on disks is instantly available. Almost all information is now stored on disk.

When data is needed from a tape or cartridge, the engineer requests it through his terminal. That sends a message to the mainframe computer located in Holtsville.

An operator there receives the message, locates the appropriate tape or cartridge, and loads it into the next available drive. The engineer can then call up the information on his computer screen.

In addition to storage management, the tape and cartridge group maintains an inventory of these resources. Reports are prepared that show problem trends, resource reliability and overall utilization of the media from the time the data is generated and stored to when it is no longer needed and erased.

"Detailed procedures are in place to safeguard the data while it is stored and to prevent access by unauthorized users," says Watson.

A second area of the department, Direct Access Storage Device (DASD) management, is concerned with disk equipment.

DASD makes sure there is enough disk space to satisfy the data base requirements of Grumman users. As in the tape and storage area, reports are generated showing DASD use.

Software tools used to manage tape or disk use are either purchased or written by the software support group. This group is responsible for the development and maintenance of most of the software used in Media Control.■

No Wasted Space. *Above, Gloria Nelson works in the Software Support group of Media Control. They write the software for managing tape and disk use. Marie Eatz retrieves a requested cartridge from the library. After she loads it, the engineer can call up the information on his terminal. (Photos by Bob Sagliocca).*

Instant Information. *Kathy Quinn locates one of the 100,000 tapes and cartridges the Media Control Department stores at Data Systems' Holtsville facility.*

Milestones

(Continued from page 9)

Albert L. Spencer, Bethpage, Aircraft Systems
Ronald E. Strickland, Patuxent River, Aircraft Systems
Arthur G. Tomlinson, Los Angeles, Aircraft Systems
William K. Toolan, Bethpage, Aircraft Systems
Raymond F. Travelyn, Calverton, Aircraft Systems
John Triolo Jr., Bethpage, Aircraft Systems
Michael Ugenti, Melville, Electronics Systems
Charles S. Valleau, Bethpage, Aircraft Systems
Andrew J. Vitzthum, Bethpage, Aerostructures
Leroy H. Wagner, Bethpage, Aircraft Systems
Ernest G. Wanke, Melville, Aircraft Systems
Walter P. Whittard, Bethpage, Aircraft Systems
Calvin F. Wieck, Bethpage, Aircraft Systems
Joseph N. Wiley, Bethpage, Aircraft Systems
Richard P. Witt, Calverton, Aircraft Systems
Monica V. Wojtyniak, Bethpage, Aircraft Systems
James L. Woodford, Bethpage, Aircraft Systems
Joseph T. Zalesak, Bethpage, Aircraft Systems
Joseph W. Zuchorski, Melville, Aircraft Systems

Obituaries

Jacques H. Belleoudry of Computer Equipment, Melville, Aircraft Systems Division, died Feb. 5 at the age of 52. He had been with the company since 1959 and resided at 6 Market St., Centereach, N.Y.

Ronald J. Kirkpatrick of Source Inspection/Test, Los Angeles, Aircraft Systems Division, died Feb. 3 at the age of 49. He had been with the company since 1963 and resided at 947 Sandpiper Circle, Westlake Village, California.

William V. Reilly of Program Contracts, Bethpage, Aircraft Systems Division, died Feb. 5 at the age of 56. He had been with the company since 1965 and resided at 16 Arlington Ave., St. James, N.Y.

Retiree Obituaries

Michael Abbondondolo of 5 King Rd., Bayville, N.Y., died Jan 2, 1988. He retired in 1987.

Peter A. Bartolillo at RD 2, Box 242, Bainbridge, N.Y., died Oct. 20, 1987. He retired in 1973.

John W. Baumann of 446 Prospect Ave., Central Islip, N.Y., died Jan. 10, 1988. He retired in 1963.

Paul E. Behrens of 4 Donald Dr., Kings Park, N.Y., died Jan. 30, 1988. He retired in 1986.

John J. Bloodgood of Beaver Dam Ct., Royal Palm Beach, Florida, died Dec. 6, 1987. He retired in 1983.

Robert A. Boze of 25 Berkshire Rd., Bethpage, N.Y., died Nov. 28, 1987. He retired in 1975.

Harry Brown at Box 1128, Mattituck, N.Y., died Jan. 4, 1988. He retired in 1976.

William J. Burns Jr. of 34 Hart Blvd., Flemington, New Jersey, died Dec. 13, 1987. He retired in 1975.

Edward J. Callaghan of 6 Cinque Dr., Farmingdale, N.Y., died Jan. 8, 1988. He retired in 1983.

Patrick Campbell at P.O. Box 1475, Charlestown, Rhode Island, died Jan 3, 1988. He retired in 1971.

Frank Conway of 2075 Cathy Cir., Titusville, Florida, died Oct. 28, 1987. He retired in 1973.

Carl F. Cooke of 10270 Brentlawn St., Spring Hill, Florida, died Dec. 15, 1987. He retired in 1984.

Charles Cosma of 1607 Wantagh Ave., Wantagh, N.Y., died Jan. 18, 1988. He retired in 1975.

James M. Crawson of Grove St., General Delivery, Cold Spring Harbor, N.Y., died Dec. 31, 1987. He retired in 1967.

Harold K. DeMott of 8808 19th St., Alta Loma, California, died Dec. 28, 1987. He retired in 1975.

Michael Dysko Jr. of 138 Shady La., Smithtown, N.Y., died Jan. 22, 1988. He retired in 1973.

George W. Eisenhower of 8581 N. Golfview Dr., Citrus Springs, Florida, died Jan. 27, 1988. He retired in 1977.

Chester R. Engvaldsen at P.O. Box 62, Rowland, Pennsylvania, died Dec. 21, 1987. He retired in 1979.

Francis Farmlett of 52 Rodney Ave., Islip Terrace, N.Y., died Dec. 28, 1987. He retired in 1970.

Frank E. Feggeler of 30 Thorne Ave., Hempstead, N.Y., died Oct. 27, 1987. He retired in 1968.

Thomas M. Flanagan of 200 Merrick Rd., Amityville, N.Y., died Oct. 9, 1987. He retired in 1965.

Thomas H. Goddard of 493 N. Bayport Ave., Bayport, N.Y., died Jan. 18, 1988. He retired in 1981.

William W. Hichborn of Rt 1, 931 Marcy Dr., Deland, Florida, died Dec. 18, 1987. He retired in 1970.

Stephen Impellizzeri of 21 Corlett Pl., Huntington Station, N.Y., died Dec. 15, 1987. He retired in 1970.

Paul J. Jack of 9 Galway Pl., Huntington, N.Y., died Dec. 29, 1987. He retired in 1971.

Francis J. Kane of 72 Fairfield La., Roslyn Heights, N.Y., died Jan. 12, 1988. He retired in 1975.

Charles Klosowicz of 6 Teak Ct., Whiting, New Jersey, died Dec. 10, 1987. He retired in 1978.

Frank Kmiotek of 537 Latham Rd., Mineola, N.Y., died Nov. 1, 1987. He retired in 1969.

Albert A. Knight of 5 19th Ave., North Babylon, N.Y., died Jan. 12, 1988. He retired in 1973.

Joseph R. LaMacchia of 839 Strang Dr., Wantagh, N.Y., died Dec. 11, 1987. He retired in 1979.

Sidney Levey of 3221 Beltagh Ave., Wantagh, N.Y., died Nov. 22, 1987. He retired in 1984.

John B. Marvin of 57 Avondale Dr., Islip, N.Y., died Nov. 27, 1987. He retired in 1975.

Richard D. Mase of 3 Tims Trail, Shelter Island, N.Y., died Jan. 3, 1988. He retired in 1984.

Patrick J. McGuire of 32 Anstice St., Oyster Bay, N.Y., died Dec. 24, 1987. He retired in 1965.

Fred H. Meiners Jr. of 3512 Stephen La., Wantagh, N.Y., died Jan. 27, 1988. He retired in 1982.

Alfred H. Moser of 6761 NW 44 Terrace, Coconut Creek, Florida, died Jan. 14, 1988. He retired in 1975.

Frank Neri Jr. of 9 W. Walnut St., Islip, N.Y., died Jan. 23, 1988. He retired in 1985.

William O'Neill of 124 Hampton Ave., Westfield, Massachusetts, died Jan. 1, 1988. He retired in 1978.

Richard Palmer of 49 Claremont Ave., North Babylon, N.Y., died Jan. 10, 1988. He retired in 1978.

Walter M. Pridham of 55 S. Osceola St., Beverly Hills, Florida, died Dec. 21, 1987. He retired in 1976.

James Reimer of 875 Jerusalem Ave., Uniondale, N.Y., died Nov. 8, 1987. He retired in 1961.

Thomas P. Rowland of 623 Village Dr., Patchogue, N.Y., died Nov. 3, 1987. He retired in 1978.

Louis Samberg of 10806 William & Mary Ct., Orlando, Florida, died Jan. 4, 1988. He retired in 1976.

Anthony R. Schiavone of 915 Pearl St., Bohemia, N.Y., died Dec. 26, 1987. He retired in 1984.

Otto Schindlar of 2273 13th Ave. SW, Largo, Florida, died Jan. 10, 1988. He retired in 1971.

Luciano J. Scirica of 1624 N. Rabeck Ave., Lecanto, Florida, died Nov. 29, 1987. He retired in 1983.

Loren Shultis of 13 Byrd Ct., Kings Park, N.Y. died Dec. 11, 1987. She retired in 1965.

Nicholas Tallarico of 148 Third St., Hicksville, N.Y., died Dec. 1, 1987. He retired in 1984.

Anthony M. Ventura of 46 Oakley Dr., Huntington Station, N.Y., died Oct. 26, 1987. He retired in 1981.

Francis S. Walkowski of 17 Fulton Ave., Hicksville, N.Y., died Sept. 7, 1987. He retired in 1982.

Pedrito Walters of 20 Coolridge Ave., Amityville, N.Y., died Sept. 26, 1987. He retired in 1977.

John J. Washington of 5163 Cortez Ct., Delray Beach, Florida, died Dec. 9, 1987. He retired in 1970.

Maurice S. Watson of 9157 SW 23rd St., Ft. Lauderdale, Florida, died Dec. 22, 1987. He retired in 1973.

George Weiderman at P.O. Box 81, Essex Center, Vermont, died Oct. 15, 1987. He retired in 1977.

Gerald Windus of 71 Tree Rd., Centereach, N.Y., died Dec. 4, 1987. He retired in 1987.

Upwardly Mobile. *Grumman's Dick Opsahl found that no marathon he's ever run could match his experience in Nepal.*

His Running Form Was At Its Peak

Grummanite Dick Opsahl successfully ran in the first Everest marathon. The November 1987 marathon in Nepal was billed "The Highest Marathon in the World."

Opsahl, Aircraft Systems' director, Technical Liaison, and 44 runners from the U.S., Europe and the Far East participated in this combination cultural expedition and marathon.

"Our welcome at Kathmandu was like something out of the movies — banners, dancers and a band greeted us at the airport," says Opsahl.

The trek took them into valleys and up the mountains in the Himalayas, past Buddhist temples and over swaying suspension bridges. The highest camp was the night before race day, at 17,010 feet. "The only permanent accommodation was a yak herder's stone hut with space for two or three people," says Opsahl. "We slept in tents that night and went to bed wearing all of our clothing. Most people used their canteens as hot water bottles. By 6 a.m. the temperature had dropped to -10°F. Frost inside the tent produced a snow shower whenever my roommate or I moved."

After a breakfast of tea and porridge, Opsahl stuffed two heat packs into his high-top running shoes. "The first three miles took over an hour because of the extra clothes I wore."

After he warmed up, he was running at a nine-minute pace by mile nine. As the course ran down the mountain, Opsahl up-shifted. "I really let go. I started passing other runners and I finished a strong 25th out of 45 in just over eight hours and the first U.S. finisher."■

Readership Survey

We don't want to do all the talking. We'd like to know what you think about the things you see in these pages. Your comments, suggestions and complaints are welcomed. Please take a few minutes and give us your opinions.

Article	Great	Good	Poor	Didn't Read
A-6 (P. 1)	☐	☐	☐	☐
Quarterly Report (P. 2)	☐	☐	☐	☐
EA-6B (P. 3)	☐	☐	☐	☐
Technical Services (P. 4)	☐	☐	☐	☐
Advanced AEW (P. 6)	☐	☐	☐	☐
Media Control (P. 10)	☐	☐	☐	☐

Suggestions For Future Articles:.....

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Comments About This Issue:.....

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.....

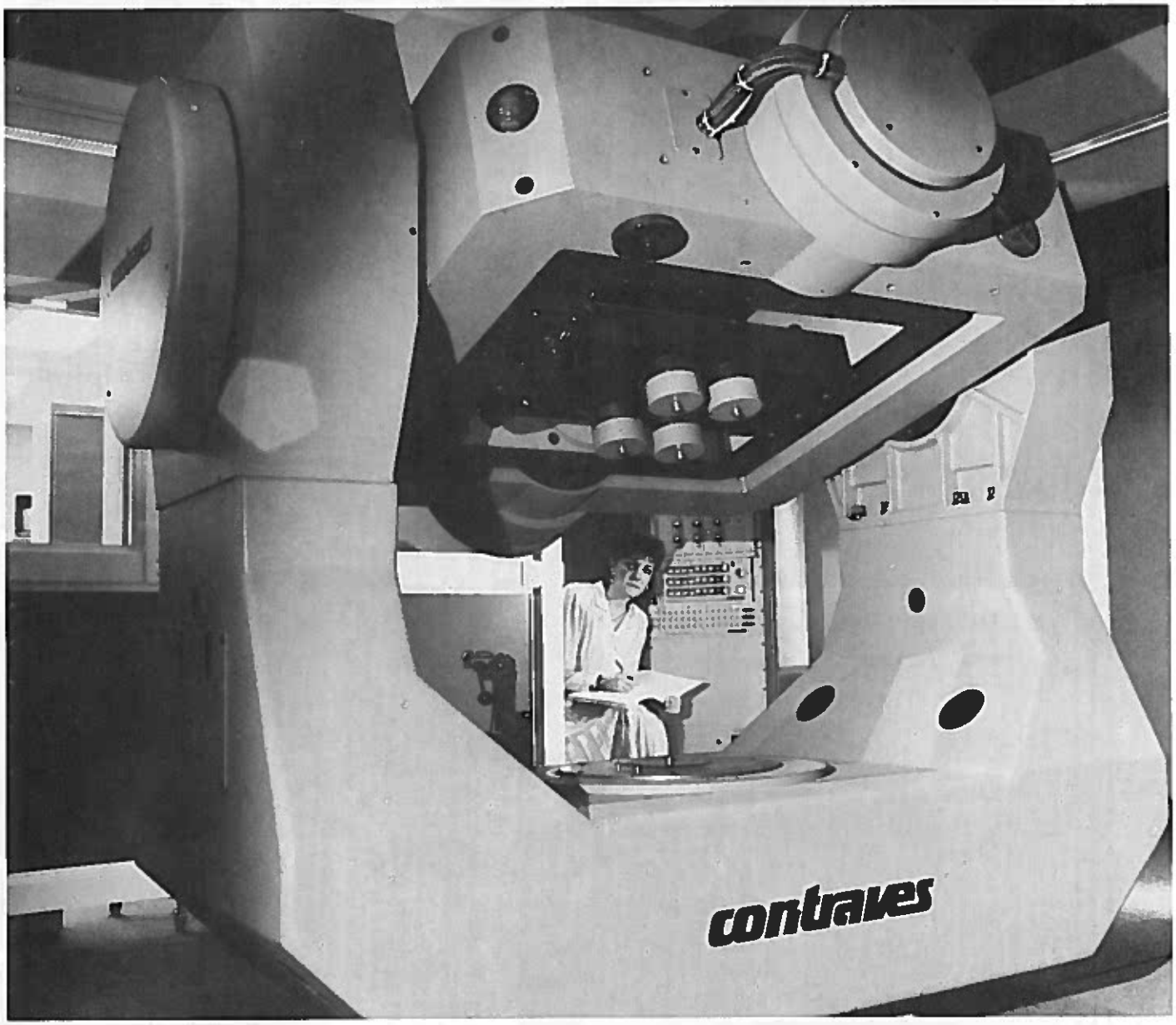
Name.....

(Required If You Wish A Reply) **Ext.**.....

☐ Retiree **Division**.....

Mail to: Grumman World, A22-GHQ
1111 Stewart Ave., Bethpage, N.Y. 11714

GrummanWorld
February 26, 1988



(Photo by Bob Settles)

Every Which Way But Loose

Using this Flight Attitude Table, engineer Ellen Stahl can test the effect of rapid movements on aircraft guidance instruments.

Located in Bethpage's Navigation and Control Equipment lab in Building 14, the table is a three-axis motion simulator. The instrument is mounted on the center section and spun at a top speed of nearly two revolutions per second. That's faster than an aircraft can spin.

Engineers usually run independent tests in the lab. However, they have also set up a temporary link with the F-14 lab. While an instrument is being spun on the table, engineers in the F-14 lab can monitor the simulated effects on the aircraft.

Eventually, the lab will be linked to others in Building 14 through a high speed data base.

Entry Deadline Is March 4 For '88 Photo Contest

All Grummanites are invited to enter the 1988 Public Affairs photography contest.

Winning entries will be enlarged to 20 x 30 inches, framed, and then displayed in Corporate Headquarters for one year. Upon completion of the exhibit, the framed prints will be returned to the winners along with an 8 x 10 inch negative of the print.

Here are the contest rules:

★ All photographs must be in color.

★ Any size print can be submitted.

★ An original negative or slide of the submitted photo must be available upon request.

★ All photos must be clearly labeled with your name, mail stop, and telephone number.

Entry deadline is March 4; winners will be announced by March 20.

Mail entries to Monique Monaco, A33-GHQ. If you have any questions, call Monaco on (516) 575-2898.

EIP Match

For the second quarter of 1987, the Employee Investment Plan's company match will be 50 percent. The matching rate floats between 50 and 100 percent, according to the company's financial performance during the preceding four quarters.

Frequent Fliers

The Travel Department now has Eastern Airlines Air Shuttle Commuter Value Pack ticket booklets which offer a 30 percent discount for business travel between New York and Washington or Boston. Each pack includes 10, one-way shuttle tickets. To take advantage of this discount, you must be traveling on company business, take a complete book, and use the tickets by the end of 1988. Contact Josephine Brune, (516) 575-2727.

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